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PLANNING IMPLICATIONS FOR NATIONAL SECURITY OF OUTER SPACE IN THE 1970's

BASIC NATIONAL SECURITY POLICY

PLANNING TASK I (2)

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Planning Implications for National Security of Outer Space in the 1970's

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PREFACE

This Report was prepared by a committee drawn from the interested Departments and Agencies, and has been reviewed at the Secretary of State's Policy Planning Meeting, and by the Planning Group. There are individual points or formulations with which one or another of the contributing committee did not fully share, and the formal concurrence of the heads of the Agencies concerned has not been sought. Nonetheless, differences of view in the course of preparation of the study were resolved by agreement, and there are no recorded dissents, though we would have presented such if they had remained. The Terms of Reference of the study are appended as Annex A.

With the passage of time since this Report was prepared, developments have moved decidely forward two of the main points raised in the study. United Nations General Assembly Resolution 1884 (XVIII) on October 17, 1963, with co-sponsorship and accompanying declarations of policy intent by the US and USSR Representatives, gave form to a US-USSR agreement to ban the stationing in outer space or placing into orbit of nuclear weapons or other weapons of mass destruction, as recommended by this Report.

President Kennedy in his address to the UN General Assembly on September 20, 1963, proposed further US-USSR cooperation in joint space ventures, including the possibility of a joint expedition to the moon. Further study of this possibility is now underway in the US Government. The conclusion of this Report recommending study of the possibilities of later US-USSR cooperation in inter-planetary exploration remains for further consideration.

Among the useful purposes of this study has been the identification of certain related matters requiring further examination. Two particular examples deserve note. First, the opportunities and dangers which direct space-to-home communications deserve, and are now receiving, close attention in the Department. Also, the subject of weather manipulation, which space activities relate to only indirectly, is now also being further studied.

Finally, I should like to note that this has been a pioneering study, the first to relate the scientific-technical, intelligence, and political factors involved in our future space policy relating to national security problems. As time goes on, continuing review will be necessary. One cannot, at this time, predict when a comprehensive review will be required, but in the meantime recipients can use this study as background and foundation.

I should like to thank the members of the Committee responsible for preparing this useful study.

W. W. ROSTOW

Committee on "National Security Policy Planning Implications of Outer Space in the 1970's, "Basic National Security Policy Planning Task I (1)

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CONCLUSIONS

A. The implications of exploration and use of outer space in the 1970's indicate clearly that, from the viewpoint of its national security in the broadest sense, the United States must continue an active space program. This program should place its main emphasis on broadening our horizon of knowledge and breadth of competence in this new medium, with particular attention both to the political implications of our achievements measured against those of the USSR and to the assurance of our national security. We should be alert to particular political prestige considerations in space activities. We should continue to encourage international cooperation in space activities, through appropriate international organizations, including the U.N., and through bilateral arrangements (including with the USSR), and embracing the development of space law. We should continue to stand on the general principle of freedom of space. We should actively seek arms control arrangements which enhance national security. We should pursue vigorously the development and use of appropriate and necessary military activities in space, while seeking to prevent extension of the arms race into space.

There follow several conclusions concerning selected aspects of space activity which deserve particular attention from the viewpoint of national security policy.

B. Military activity in outer space will not be sui generis; rather, it will relate to the character of, and balance among, earth-based military systems. The essential requirement for military capabilities in outer space will be the need for research, development, testing and operational activity sufficient to enable the U.S. to avoid technological surprise in outer space, and to achieve and maintain that margin of superiority in space activity necessary as insurance to offset possible Soviet military developments. Space activities of military value can be conceptually divided into three main categories: (a) basic developmental work (e.g., systems for sustained manned space flight, rendezvous and inspection capability, and in general, broadening and exercising space competance), (b) support systems (e.g., communications observation, navigational aids, and the like), and (c) spaceborne weapons systems, for offensive use against other spacecraft or targets on earth, or for defensive interception in or from space of hostile earth or space launched offensive weapons.

1. We should study fully the possibilities of relatively low-cost launching and in-flight propulsion systems which could alter cost efficiency criteria and provide maneuverability, range and speeds which would have very important potential civil and military uses.

2. Space support systems of military value are already under active development and use, and should continue to be

pursued fully. As particular spaceborne support activities become increasingly important, so does their defense and preservation, though excessive dependence on any single and potentially vulnerable means should of course when possible be avoided in space as on earth.

3. An anti-satellite capability (probably earth to space) will be needed for defense of the United States, and may also be required to ensure freedom of space. Current high priority efforts should be continued, and extended as necessary in the future.

4. Weather manipulations may, conceivably, become an important weapon, and begin to become relevant even as early as the 1970's, though we cannot yet identify the particular techniques. While this is not primarily a question of space technology, it may be useful to study possibilities of "weather control", and warning and countermeasures of such control (including possibilities for international measures), in space.

C. We would place one particular constraint on our space program for military purposes: avoidance of actual deployment in outer space of any spaceborne weapons of mass destruction so long as the USSR refrains from deploying such weapons. We conclude that the United States should continue to favor and to seek a tacit or negotiated arms control agreement banning the placing of weapons of mass destruction into orbit.

1. While we recognize that technological and political conditions change over time, as viewed from the perspective of 1963 we see the situation in the 1960's and 1970's as warranting this policy. This approach should not be regarded as binding one hand behind our back, but as an effort to prevent, if possible, extension of military competition into a new dimension which has new risks and costs and which we would do well to avoid. Of course, the choice may not be ours -- but it may. We should actively pursue research and, as necessary, developmental work on possible weapons systems. Also, if we were to develop a new weapons system requiring placement in space of weapons of mass destruction which promised to alter the military situation radically in our favor -- although we do not now foresee such a development -- and even assuming we were confident the Soviets did not have it, the question whether to deploy it should of course be posed, so long as there were no binding international agreement prohibiting it.

2. Clearly, the United States must also consider the possible effects of any introduction of non-nuclear spaceborne weapons on stimulating or justifying Soviet initiation of the deployment of nuclear weapons in space. We favor retaining the option of deploying spaceborne non-nuclear anti-missile or anti-satellite systems that may be developed, but decision on

their stationing in space should include consideration of the effect of such action on our efforts to prevent extension of a nuclear arms race into outer space.

D. There may be a substantial change of pace and emphasis of over-all U.S. outer space activity during the 1970's. Such a change may begin shortly after a manned lunar landing. The novelty of space will have passed away, but there will be new challenges in space. We will have redressed our present inferiority in space boosters, and our program will be less dependent on reacting to a Soviet lead, particularly if we first achieve a lunar landing. There is no question that we are in space to stay, and in a large way. However, a change of pace could occur and could apply to the character and to the scheduling of our over-all program, and in differing degree to various parts of the program: to further lunar exploration, to subsequent interplanetary exploration, to space applications involving satellites in earth orbit (e.g., communications satellites, meteorological satellites, navigational satellites), and to the general balance between scientific investigation and practical application.

E. The nature of outer space activities, and of the international context in which they will develop, poses the prospect of increased international interdependence in this field. The United States should regard this prospect as an opportunity and seek international cooperation in space and space-related activities not only from the

point of view of gaining such foreign support as our program may require, but also from the standpoint of the broader foreign policy objectives which can be served. The character of this cooperation will, however, change in the following significant respects:

1. There will be an increasing need for tacit or negotiated international agreement for the conduct of our space program (frequency allocation, rescue and return of astronauts and spacecraft, effective channels for the exchange and analysis of data, etc.). Space law, at least through customary usages of space, will continue to develop, and the United States should encourage this development.

2. We will have to take account of active and increasingly sophisticated space programs conducted by other countries, particularly the Western European countries and Japan. Substantial involvement of these countries in space programs will afford a greater opportunity to encourage multilateral programs as opposed to purely national or bilateral programs.

3. Communications satellites will facilitate international intercourse, and will probably be capable of serving either cooperative or adversary use for direct communication to the homes of populations in other lands. The opportunities, and dangers, of this technique deserve careful further study.

4. Outer space developments tend to accentuate, rather than mitigate, the differences between the industrial countries on the

one hand and developing countries on the other. There may be an increasing reaction in the economically underdeveloped countries against great expenses in space exploration while millions on earth barely subsist. The United States should therefore continue to be responsive to the desire for international participation in some outer space programs.

5. It is possible that by or during the 1970's some disarmament and/or U.N. peacekeeping arrangements will come to use spaceborne observation. The U.S. should consider possible ways of facilitating such international uses of observation satellites without jeopardizing essential unilateral capabilities.

6. The United States should consider the desirability, and feasibility, of proposing or accepting a joint US-USSR major space effort on the order of magnitude of a lunar landing in lieu of a competitive race in the 1970's. An evaluation should be made of the long-run political potential for altering the US-USSR relationship by such a dramatic development. In this connection, even a joint effort to make a lunar landing should not be excluded. This evaluation would, of course, have to take into account the fact that political assets accruing to the United States in the event of our making the first lunar landing would be sizeable, and that formidable and possibly prohibitive technical problems would be involved in a joint effort.

I

INTRODUCTION

As we look a decade into the future, many of the problems and questions which trouble us today will have been resolved—for the better or the worse. Others that we cannot be expected to foresee today will have arisen. Nonetheless, it is useful to project ourselves into the future as best we are now able, to help us in anticipating those problems which may loom largest, and thus to assist our policy planning to meet them.

Why have nations wished and worked in the 1950's and 1960's to get into space? We can, perhaps, for the present analysis, distinguish four national purposes:

(1) Political Prestige and Propaganda

(2) Scientific Inquiry

(3) Possible Military Uses

(4) Possible Economic Payoffs

Such a complex of motivations underlies the programs of both the USSR and the United States, and doubtless future space powers, though the relative weight of these several considerations varies significantly. In particular, the Soviet Union was quicker to recognize, and has on the whole been more concerned with, the political factors of prestige and propaganda than has the United States. This difference has been manifested from the very beginning in the successful Soviet attempt

to orbit the first artificial earth satellites, a race they won chiefly because we did not know that a race was underway (or that the prize would be so great). We forfeited the first round. The difference in relative role of political motivation has also been evident in the continuing Soviet practice of giving very high priority in their space program to the achievement of additional prestigious "first" achievements.

Political impact is a perfectly legitimate objective. It is, to be sure, only one of several objectives; it cannot be allowed to shape the whole space program. But we deny it its due only at our own disservice and disadvantage. Science and technology, just as military power, are elements of political strategy. Space activities cannot be kept quarantined from political influences here on earth. The political challenge, and the political shadow of scientific-technical development, do affect our national security.

Scientific inquiry is a basic motivation for space exploration. Far more is involved than the satisfaction of human curiosity. We live in an age in which science has come to play a central role, and in looking ahead to the unknowns of the 1970's, we are acutely conscious of space-related fields. Such an effort is, in fact, one of the few forms of insurance that can be taken out against the hazards of the unknown. But in terms of the priorities which shape a national program, and which weigh most heavily in making the difficult choices involved in such a

program, it is not enough to speak exclusively of scientific interests, as though they were divorced from all others. Science is facing the unknown in all its dimensions: philosophical, technical, political, and military.

Military uses of space are clearly important in our planning. Certain military "support" missions (such as communications, observation, navigational aids, geodosy, and the like) are evident. Many of them are already being developed. Potential requirements for offensive or defensive spaceborne weapons systems are uncertain. By and large, the motivation for exploring and developing such space systems is more a matter of "covering bets" from concern over uncertain and unknown potentialities than fulfilling promise of clearly expected advantages. Arms control in space can by no means be excluded, even in the absence of significant progress in disarmament on earth, though its future is quite uncertain. It is probably correct to say that there are at present no offensive or defensive spaceborne weapons systems which either side considers a firm requirement. Nonetheless, as we look into the future we must recognize the strong possibility that some such military uses of space will be developed and will be operational. The important question of the first demonstrative placing of a nuclear weapon in space may have occurred in the 1960's; however, other possible novel politico-military demonstrations may become significant in the 1970's.

Economic considerations will almost certainly continue to serve both as a constraint, and as a motivation for expanded space activity. There are at least three respects in which positive economic considerations may have become important. First is the general effect on space-related industry, and indirect benefit to other fields of science, technology, and industry. This motivation may, for example, be very high among Europeans and the Japanese in particular; it is also pertinent to our own interests. Secondly, cheaper means of space launching and space transport will probably have led to more widespread use of space. Finally, long distance earth communications may have been shifted substantially to spaceborne systems.

But political and scientific considerations have probably predominated to date, with the former certainly stronger at least in the Soviet Union. To note once again, the early Soviet recognition of this potential gave them the opportunity to help to offset internal disorientation attendant on destalinization and reverses in Eastern Europe in late 1956, and to startle many in the outside world into belated (and often exaggerated) recognition of Soviet scientific and technical achievement. Above all, it served to encourage communists and to persuade some others that the Soviet Union was riding the wave of the future. Among the many subsidiary effects, Sputnik gave credence to the initial Soviet ICBM claims and helped to provide the steam for the "missile gap" balloon

which, before it was finally punctured in 1961, cast a large shadow. To be sure, Sputnik (and the ICBM "missile gap") spurred us on to greater efforts, not only in a large space program, but in other ways (including support to education), and stepping up our military program to an extent that by now has created a real missile gap in our favor. But we should not lose sight of the great damage to US prestige, and contribution to Soviet political power, which the Soviet Sputnik caused in the late 1950's.

The key technological foundation, not only for Sputnik but for all the Soviet space achievements to date and for several years yet to come, has been the basic propulsion system. A large thrust rocket was developed for the first generation Soviet ICBM (SS-6), at a time when the state of Soviet nuclear weapons technology required a very large thrust rocket engine in order to deliver the warhead payload. The Soviets have masterfully exploited for spectacular space achievements the many advantages which their continuing superiority in rocket thrust has given them.

Even granting that the United States may be ahead in many scientific achievements in space, and even assuming that we probably have a superiority in present development work toward future very large thrust engines, most people in the world still believe that the Soviet Union is today more ahead of the United States than in fact is the case. And this initial advantage

is not yet played out--it is possible that the Soviets may get to the moon first, perhaps even by ingenious coupling of basic SS-6 engines without needing to match our Saturn V or even the I.

By 1970, the decade of spectacular "firsts" which the Soviets bought by their original dual-purpose missile and space rocket engine will finally have come to an end. It is possible that by then man's interest in new accomplishments, in which the United States may have a lead (due to propulsion projects now being developed), may have dwindled. Or, we may finally be reaping the rewards of our "building period" of the 1960's. But we must be alert to any possibility that the Soviets may leapfrog us again. It is incumbent upon us in planning policy now to avoid a second round of Sputnik-fever in the world.

The broadest, and perhaps the deepest, impact on our national security will probably come from the political challenge and the way we meet it. A direct military challenge is uncertain. The probability, indeed, is that military uses of space will continue in the 1970's to be contributory to more fundamental elements of the military balance on earth. Even in that case, of course, such uses will be important--in support functions such as reconnaissance and communications, and even in possible weapons systems if such are deployed in space. We should face squarely the likelihood that military developments in space will not be "decisive."

Yet by the very token of our uncertainty and mindful of past humbling errors of our underestimates of the pace of technological development, we cannot rule out the possibility of some development or series of developments which may transform the elements of military power in ways beyond our ken today. For that reason, without predicting either technological frontiers or future politico-military decisions of either the Soviets or ourselves, it is necessary to consider some of the possibilities of the 1970's.

Much, probably too much, has been written about space as the "high ground" of future war, and declamations to the effect that he who controls space will control the earth. Space is not predictably or inevitably the key to future military power. It is, however, enough to deserve our close attention that unpredictably and conditionally it may become so. Much also is alleged about Soviet intentions in space, based largely on their aspirations on earth and assumptions of maximum capable effort in space. Here, too, it is quite enough to say they may try, and may succeed, in pursuing some promising avenue of development with important military implications. It is too much to say they will do so; it is not a foregone conclusion. Finally, we must concern ourselves with the possibilities of military breakthroughs not only in order to match or offset any Soviet accomplishment and avoid disadvantage to ourselves, but in order to find new paths which may give us politico-military advantages.

The purpose of the present paper is to outline, in a preliminary inquiry, some of the principal implications that appear relevant for present national security policy planning of a projection of foreseeable trends in space development, leavened by attention to unpredictable developments or factors which may change the picture importantly. The discussion is generally in the nature of a broad survey rather than a detailed examination of specific possibilities. Although such an approach has its limitations, it may be the most useful way to bring a highly speculative field into better perspective.

II

PROJECTION OF PRESENT OUTER SPACE ACTIVITIES

A. GENERAL TRENDS

If we extend present trends in the civilian exploration and use of outer space and in the performance of military support missions in space along the lines already partially initiated or programmed, a composite picture of the space environment in this area during the 1970's would probably present such features as the following:

1. The conduct of most space activities of a non-weapons character will long since have been accorded routine public acceptance, and much of the newness and excitement of a major pioneering effort will have passed after a manned lunar landing has been achieved. To the extent that either the United States or the Soviet Union precedes the other in effecting such a landing, there will probably have taken place an intense stage of national rivalry reflecting an effort on the part of the one to exploit its accomplishment and on the part of the other to overtake it. However, after the objective has been attained by both, somewhat contradictory emotions will have been set in play. On the one hand, the accomplishment will have spurred man's self-confidence and possibly whetted his appetite for still newer worlds to conquer. On the other hand, as space exploration moves into the phase of manned interplanetary spaceflight, much of the incentive to utilize "space spectaculars" for

national political purposes may have spent itself. This does not mean that there will be lack of interest or absence of drama in respect to future space accomplishments, but whether or not some new focus of attention will have emerged to seize the public imagination or to become the object of continuing national rivalries, space activities will have been placed in a new context and focus.

2. For the two initial contestants in the space race, the Soviet Union and the United States, many of the technological stumbling blocks of the early space age will have been converted into building blocks of wide variety and capabilities. The availability of more powerful boosters (in particular the nuclear rocket) will make it possible to place payloads of, say, 400,000 pounds in low earth orbit or accelerate payloads of 150,000 pounds to escape velocities. Spacecraft will be capable of an increased degree of maneuverability (including rendezvous, docking, and transfer maneuvers) and of station-keeping; improved in-space propulsion will assist such basic maneuvers, permit some degree of change in orbital inclination and altitude, and facilitate the accomplishment of deep space missions. Improved power sources, will supply kilowatts, and perhaps megawatts, of primary power. Instrumentation will be available for a wide range of scientific and applied purposes, and improved environmental equipment and techniques will be capable of sustaining life over prolonged periods

in space. At least one new type of spacecraft, the transport or ferry spacecraft, will be performing maintenance, supply, and personnel rotation maintenance.

3. As a consequence of such developments, the spectrum of space objectives attainable by both the Soviet Union and the United States will have broadened substantially. For example, growing experience with manned space activities may lead to manned planetary explorations in the 1970's. In the case of most space activities, the important weight question (a question presently more significant for the United States than for the Soviet Union) will be what payload weight is required for a particular mission rather than what payload weight can be launched; any continuing space competition will proceed on some basis other than simply relative weight-lifting capability. Although continued technical effort will be required to achieve even higher performance missions, probably neither country will be technologically limited in any basic sense in near space; however, relative mastery of specialized areas of advanced technology (of which laser, or optical maser, technology is perhaps currently the best example) might make a significant difference in the relative capabilities of the two countries. The cost per pound in orbit will have decreased, but short of a "cost breakthrough" in space propulsion, the cost of the largest, heaviest, or most distant space missions will probably remain

very high. In any case the cumulative cost of space efforts will be extremely large. As a general matter, political, military, economic, and social considerations will have superseded technical factors as the principal determinants of the limits within which most space activities of the two countries are conducted.

4. Although the Soviet Union and the United States will continue to be the leaders in the exploration and use of outer space, the field of contestants will have been enlarged as the result of the acquisition of space launching capabilities by additional countries or groups. Drawn largely from the ranks of the already industrialized nations, such countries or groups will have been motivated by the desire to keep abreast of the most advanced technology and also by the desire to enjoy the increased bargaining power conferred by the ability to exercise a choice between competition or cooperation with the original space powers. Whether such additional space powers ultimately become competitors in the manned exploration of space, their emergence will have added a new dimension to the politics and economics of the space age. Although it is not probable, relatively cheaper space flights may contribute to some national proliferation of space capabilities in the 1970's.

5. The performance of communications and observation functions by spacecraft will have encountered varying degrees of

controversy in passing from early launchings of a sporadic and experimental character into the phase of full-scale operations with highly sophisticated spacecraft. The primary questions will prove to have been not whether these applications would survive controversy, but the form in which they will have survived and the degree of international participation or sponsorship that will have materialized. In any case, spacecraft in these fields will have narrowed the gaps between the continents, and, however fully they may be exploited, these new means of inter-penetration among areas and societies will have become permanent fixtures.

6. Taking into account the increased number of space powers, the wider range of activities made accessible by technological advances, and the establishment and maintenance of operational systems (each presumably involving a number of spacecraft simultaneously in orbit), the rate of space launchings and the cumulative amount of traffic in space at any given time will have increased substantially. These conditions will have generated a corresponding growth of the problems of space-traffic accounting, non-interference, and coordination.

7. Although advances in the technology and techniques of spaceflight will have further blurred the line between air space and outer space, the space powers will continue to have found it to their advantage to emphasize discontinuities rather than continuities and to

insist on a certain separate identity for outer space in order to trade on the freedom of action derived from and partly dependent on recognition of non-sovereignty in outer space. Nonetheless, the increasingly complex pattern of space activities and the relationship of such activities to earthly pursuits will have resulted in some growth of space law and the establishment or renovation of international institutions of a cooperative or regulatory character. Such steps will have been regarded as necessary not only to bring order into relations among the space powers but also to bridge the differences between the space powers and those countries which, although not possessing space launching capabilities, will play a prominent role in providing support to or in "consuming" space activities voluntarily or involuntarily. Whether or not this growth of law and institutional arrangements represents an entirely satisfactory accommodation of the interests of each of the groups involved, it will certainly not be practical for the space powers to consider freedom of space international, and responsibility national.*

B. NATIONAL SECURITY IMPLICATIONS

If the foregoing picture approaches a reasonable degree of accuracy even in its broad outlines, it suggests several questions bearing on the national security. In many respects the questions are not new, but examining them in longer-range perspective may assist in new evaluations. The order in which some of these questions are outlined below is not intended to imply priority.

*Section C below addresses itself in more detail to trends in international cooperation.

1. The Aftermath of the "Moon Race." The Soviet Union and the United States have backed into a race for the moon for psychological and prestige reasons. The United States, in the Spring of 1961, adopted as a national space objective the task of placing a manned expedition on the moon before the end of the 1960's. The decision to focus much of our national space effort on this objective is expensive in terms of the national resources required for its accomplishment. On the other hand, it is a project which has captured men's imaginations everywhere. Its successful accomplishment will provide a tremendous increase in the nation's technological capability and, if in advance of comparable space undertakings by the Soviets, will greatly enhance national prestige. Whether the Soviet Union regards itself as engaged in a "race" with the United States for a moon landing has not yet been proven.* In the eyes of much

* It is assumed here that the Soviet Union is publicly committed to the race at the present time whether it wishes to be or not. Available intelligence is insufficient to prove that the Soviet Union regards itself as a contestant in a "race" for a moon landing, although the preponderance of evidence suggests that the moon constitutes an important objective of the present Soviet space effort. The strong possibility that the USSR is, in fact, engaged in an effort to precede the United States with a manned moon landing must be recognized, and analysis of the implications of a Soviet "first" in this regard should comprise an important element of US policy consideration. On the other hand, alternative possibilities should also be borne in mind in order to provide sufficient flexibility in our policy thinking.

(Footnote continued on page 16)

of the world, however, such a "race" is in progress. Therefore, barring some prior Soviet achievement of a magnitude that would preempt or overshadow a moon landing, the nation that is first to place a manned expedition on the moon will be regarded as the victor in a contest having major implications. In looking ahead to the 1970's, it would accordingly seem important to consider what effects might have followed from one country or the other having finished first, and how subsequent activities related to the moon and to planetary and interplanetary explorations might best be conducted.*

a. Achievement of a manned lunar landing will be an historic and dramatic event of the first magnitude. How much this event will have weighed in the over-all balance of United States-Soviet relations at the time depends to a large extent on what may happen in other areas between the present and the period when the moon becomes directly

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(Footnote continued from page 15)

Assuming that a "race" for a manned lunar landing is in progress, the possibility exists that the Soviet Union might unilaterally withdraw (ostensibly to devote its resources to more "humanitarian" ends), if it thought it might lose the "race" or if the burden on its resources became too great. Under such circumstances, it is not inconceivable that, after the United States had borne most of the costs of a lunar program, the USSR might display a desire for "cooperation" by offering to merge efforts with the United States.

Another possibility which should be recognized is that, rather than participate in a race of uncertain ultimate value, such as a manned lunar project, the USSR might be devoting its national resources toward attainment of some other space goal of competing international appeal but capable of earlier accomplishment and, perhaps, broader exploitation, such as a large manned orbital space station.

* The weight of informed judgment is strongly against the likelihood of sentient life existing in the solar system, so we do not consider in this paper the hypothetical question of the security effects of the discovery of allies or enemies on other planets.

accessible to United States astronauts and Soviet cosmonauts. Nonetheless, it is probably safer to assume that the event will have had a significant impact than to assume that it will not, and it is useful to consider, inter alia, its impact on United States-Soviet relations in the post-lunar period.

(1) The course of Soviet post-Sputnik diplomacy clearly indicates that triumphs in space are not substitutes for triumphs on the earth. Nonetheless, it can also be argued that the Soviet Union might have fared even considerably less well without the buoyancy imparted by its successful exploits in space. The latter enabled the Soviet Union to command attention and no little respect, and the Soviet Union skillfully parlayed its exploits into an image bigger than life (an image that has, however, to a large extent been deflated by the self-confidence demonstrated by the United States during the past two years). But, other things being equal, a Soviet first could be viewed as signaling the continuing (or renewed) vitality of the Soviet system and the Soviet form of Communism, and as demonstrating Soviet ability to win a prolonged race with the Capitalist United States. The Soviet version of manifest destiny would derive some additional impetus from these considerations. Even if such gains accomplished nothing more than partially to off-set possible losses in other areas, there would be little reason to believe that the course of United States-Soviet relations would run more smoothly than before.

If a manned lunar first should happen to supplement Soviet successes in other areas, the event would not be disastrous for the United States, but it would make more difficult the United States advancement of its own objectives.

(2) For its own part, the United States has been attempting to recoup some of the psychological losses incurred in the opening phases of the early space age. For the United States, coming in first in the moon race would tend to confirm the general disposition to believe that once the United States makes up its mind to do something it follows through. It would be generally useful to cultivate this belief, and we would lose something if the belief were shaken. However, as in the Soviet case, the net value of a United States "first" would clearly depend on the situation in other areas. If we should have the Soviet Union on the run, a United States first would help keep matters moving in the same direction. If not, a United States first in this area might at least cause perturbations in continuing Soviet efforts to advance its objectives at our expense.

(3) Assuming that a moon race exists, regardless of Soviet plans, winning the race offers attractive, if not necessarily invaluable, prizes. However, winning the race will be a costly matter, and the difference between first and second prize will probably be very great. It is difficult to foresee a set of circumstances under which a

joint effort might come about,* or to describe its technical or operational character. It is questionable why the country leading at the time would wish to be quite so generous as to share honors with (or underwrite the cost for) the other. Technically, it is unlikely that the two programs could be fitted neatly together if this were at all practical, and shared control or participation would clearly present operational difficulties. Despite these considerations, a joint effort might reinforce any broader reconciliation of the interests of the two countries, and cannot be completely ruled out.

b. It is not entirely clear what man is going to do on the moon after he gets there,** but following initial landings, the period of the 1970's is likely to see additional manned and unmanned explorations, a growth of the continuing population of unmanned devices, and possibly the establishment of semi-permanent bases for periodic manned occupancy. From the national security standpoint, there will arise questions as to the pace at which such matters should be pressed (that is to say, the amount of resources that should be devoted to this end), and additional questions as to the ground rules which should govern further exploration and ultimate use of the moon.

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* Although some philosphers of the early space age have hoped that the challenge of space would have a unifying effect on earth, this has not proved to be the case, and the view taken here is that a joint effort to reach the moon would more likely be a reflection of, rather than the cause of, a rapprochement.

** It is assumed here that, in view of action already unanimously taken by the United Nations General Assembly, one thing that will not be done is to attempt to put forward claims of national sovereignty.

(1) Even if man's first step on the moon comes at the end of a highly nationalistic and competitive race, it does not necessarily follow that his subsequent lunar activities need be conducted at the same pace or in the same spirit. The adoption of a steady but more deliberate pace would seem desirable, as would the adoption of the principle of mutual non-interference in exploration and use of space. The problem of mutual relations of US and Soviet men on the moon requires timely study.

(2) Beyond this there will arise the question of whether any specific uses should be ruled out, for example, activities which might interfere not only with other lunar-based activities but also with activities in outer space or on the earth. Whether military activities of a support or weapons character would present a potential problem would depend partly on questions of feasibility and partly on the extent to which arms control and disarmament arrangements had been achieved.

(3) Similarly, given the present state of man's uncertain knowledge of the moon, the possible need to regulate exploitation of resources (as well as position) must remain an open question.

(4) To whatever degree may prove practical, it would seem desirable to resolve as many of these matters as possible before the race is over. The conversion of the race to a joint undertaking might pave the way for a more orderly approach to subsequent

efforts. However, only if subsequent lunar activities were conducted entirely on a joint basis would cooperation offer a complete solution (one which would, of course, involve substituting one set of problems for another). Another alternative, particularly relevant to continuation of national efforts, would be to reassess the applicability to the moon of the approach that has been taken to the Antarctic. That approach has not proved applicable to outer space as a whole, but it might well offer a useful precedent in the specific case of lunar exploration and use.

c. If the USSR should clearly have been scratched in the moon race, the pace of our own lunar landing program could be adjusted. It is not likely, however, that this could be established with sufficient certainty beforehand. If in the event we land first relatively uncontested, it would ease some of the above problems of coordinating or regulating use of the moon and give the US the chance to demonstrate its readiness to share the scientific fruits of lunar exploration.

d. And what of planetary and interplanetary exploration? Assuming no relatively low cost propulsion developments, the incentive for further races would seem at this distance to be fairly low; if that proved to be the case, cooperation may also be facilitated. If lunar exploration and use can be placed on a footing of international cooperation, international arrangements might be extended to cover planetary and interplanetary efforts. In the event that a moon race

and subsequent lunar activities were conducted on a competitive national basis, the question of international arrangements for other space exploration missions would still need to be considered. If it should turn out that the USSR was not really competing in a race to land on the moon, a less urgent US program for planetary exploration would be especially feasible. Questions of US-USSR or other international cooperation in such exploration could then be considered in the light of political and other circumstances existing at the time.

2. Communications Satellites.- During the 1970's, the communications satellite will be technically capable of fully demonstrating what is now only a potential impact on intercontinental communications. It will not be merely a redundant extension of existing means of communication. On the contrary, it will probably have become the major carrier of intercontinental (or very long distance) communications traffic. Its capability of handling a tremendous volume of traffic and of linking distant areas and points directly, reliably, and promptly will have opened the way for marked changes in both the total volume of communications and the traffic patterns along which communications flow. Development of a high capacity synchronous orbit communications system providing global telecommunications or perhaps a random orbit system could provide the technical basis for such changes. (However, the effect of recent high capacity conventional cable developments on

satellite communications must also be taken into account.) On the assumption that the United States has more to gain than lose through encouragement of a freer general flow of communications, the national security interest in these developments appears to lie basically in ensuring maximum exploitation of the revolutionary technological innovation which the communications satellite represents, apart from and in addition to our use of national military communications satellites. It will not be possible to do this, however, unless someone on the other end picks up the receiver, tunes in, or at least refrains from interfering. Accordingly, major political and economic problems will have to be resolved if technical potentialities are to be realized. In no case will the United States be able to exercise full control.

a. Both the general case and some specific aspects need to be examined from the longer-range viewpoint:

(1) The present United States objective of exploiting the technical, economic, and political capabilities of the communications satellite to the maximum extent leads us to support a global commercial communications satellite system. If a global system has been established by or during the 1970's, its principal operating partners, which will include but not be limited to those countries with possession of space launching capabilities, will exercise some degree of bargaining power. Such countries might include (in addition

to the United States) those Western European countries (and Australia) which are members or affiliates of the European Launcher Development Organization, Japan, and the Soviet Union. In addition, in order to achieve global coverage, a number of countries in Latin America, Africa, the Near East, and Asia (possibly including Communist China) will probably be participating in varying degrees ranging from simple user status to some more active degree of participation. Although it is far from clear at the present time what form ownership-management of such a global arrangement might take, if the broad objective of a global system has been achieved, new types of institutional arrangements to facilitate the necessary multilateral decision-making process will probably have been developed, and it is difficult to visualize how the problems involved (including working out such arrangements among the sponsoring governments and with the UN, and dealing with problems of voice in management and research, development, and procurement; financing; rates; allocation of channels; and the like) could be worked out except on an inter-governmental basis.

(2) If such problems as the foregoing have not been resolved, the 1970's may see more than one more or less independent system in operation. One might be dominated by the United States, another by Western Europe and Australia, a third by the Soviet Union.

Alternatively the United States, Western Europe, Australia, and Japan might have merged their efforts in an Atlantic Community or Free World system, while the Soviet Union might have pursued the establishment of a separate system. Establishment of a number of such systems would have reduced the efficiency of the exploitation of the communications satellite and would have created political problems of a different order. Such systems might not only have reflected political lines but have tended to freeze them still further and facilitated control within political groupings instead of cutting across lines. Under such circumstances, the non-aligned countries might have been faced with the political dilemma of some degree of political identification through affiliation with one or another system, or the economic dilemma of affiliation with more than one. Whether they might exercise increased bargaining power as a result is an interesting question. On the whole, developments along the foregoing lines might have further divided the world by the period of the 1970's.

b. No attempt will be made here to examine all special cases which might be of interest from the national security standpoint. However, note should be taken of three:

(1) The use of the communications satellite for military support will probably have come about prior to the 1970's. The communications satellite might have effected substantial improvements in centralized command of far-flung military operations. It is also possible that use of such satellites may be made in the case of arms

control and disarmament arrangements, if such are agreed. In this connection, the communications satellite might have proved the best, if not the only practical, means of servicing what would probably be a major source of traffic. Separate, specialized systems might well have been established in either or both cases.

(2) Probably through use of a general commercial system, direct communications among governments and between governments and international bodies would have been greatly facilitated. It is one thing, however, to facilitate communications, and another to ensure that the transaction of intergovernmental business will also be facilitated. Thus, for example, if less emphasis comes to be placed on the use of diplomatic representatives stationed abroad and greater emphasis is placed on more continuous direct contact among high-ranking officials of national governments and international bodies, increased pressures will come to bear on governmental decision-making processes. Even where matters of mutual interest are concerned, a political quick reaction capability will probably become increasingly important, and in adversary situations the government taking the initiative might have an increased probability of retaining it by rapidly taking its case not only to its own people but to the world at large.

(3) It is today beyond the capabilities of space relays or ground equipment to transmit directly into the home. By

sometime in the 1970's this will probably no longer be true. By the mid-1970's, it is possible that with large reactors supplying power television can be directly beamed to homes with special antennas, and by the end of the decade without the need for special antennas. Such developments will not be cheap, but especially if other missions are combined in the same space stations with high power generation, the option may be attractive. Technological advances along these lines could thus open the way for various propaganda uses. Whether the United States wished to take advantage of such a possibility to break down to some degree the Iron Curtain, or wished to discourage its exploitation and use for propaganda by the communist powers, the matter needs to be examined well in advance. Among other possibilities are the use of this technique by the United Nations. There are, in any case, obvious problems of allocations of channels, countermeasures (possibly even active ones), legality, and the like.

c. All things considered, the cumulative impact of the changes resulting from the communications satellite may be very deep indeed. During the 1970's, individual attitudes toward international matters may have experienced profound changes; national and regional parochialism may have diminished; and political and governmental processes may, as usual, be panting to keep up with the effects of technological change.

3. Observation Satellites.

[redacted]

b. With or without the consent and cooperation of those concerned, the observation satellite will have brought about an increasingly open world, and since the carrying out of observation missions probably will itself have become at least somewhat more open or will in any case be more fully understood, governments will have become aware of their relatively greater degree of exposure. Some will have resisted, but they will probably not have found any completely effective means of prolonged resistance. If resistance has indeed proved unproductive over the long term, the effects of permanently increased openness on the behavior of governments may have ranged from efforts to control even more tightly those elements of national privacy which had not been invaded from space, to reluctant acquiescence in and adjustment to the fact that national privacy had suffered an irretrievable transformation. The ultimate effect on political attitudes and relationships would, however, have depended not only on this new condition but also on possible changes in over-all political relationships and on the general course of the arms race.

c. Three special aspects of observation satellites in the 1970's should be noted:

(1) If the arms race has continued unabated into the 1970's, observation satellites will be regarded largely as national (or alliance) resources. Some broader international use of their product for political as well as military purposes may be made, but there will be little if any internationalization of systems.

(2) The usefulness to the United States of observation (reconnaissance) as a means of penetrating Soviet secretiveness is obvious. The value to the USSR may be less clear; indeed, the value is probably much lower. There are, and in the 1970's will continue to be, certain purposes for which satellite observation would be useful. The state of the art of sensor development might make such observation suitable for early-warning of alert status or attack (a capability of interest to both sides). In addition, apart from providing a general check on other sources of information, space-borne observation could provide the Soviets with intelligence on movements of Western surface naval forces and off-station location of Polaris submarines.

(3) If the arms race has continued but there has developed increased interest in reduction of the risk of war through accident, miscalculation, or surprise attack, some types of observation satellites may be in use internationally, supplementing rather than replacing national efforts. This might prove to be an especially interesting possibility if some governments concluded that they could not halt observations from space, but were nonetheless unwilling to agree to the degree of access required for implementation of major arms control and disarmament arrangements. If major arms control and disarmament agreements have come into effect, observation satellites may have come to be regarded as an international asset, and some (although not necessarily all) systems may be in operation on a fully international basis.

d. Although it is difficult to foresee a situation in which observation satellites would not continue to be useful in the 1970's, it should be recognized that the earth they will be observing may have changed in ways which are likely to have made their task more difficult. The pressures of the arms race are already driving strategic weapons and military command centers underground, under sea, and into the air. Continuation of such pressures over a prolonged period may result in the further alteration of significant features of the landscape. Nonetheless, the observation satellite will remain an important source of information concerning a changing world.

4. Navigational Aid. The use of satellites for navigational aid is an established operational technique of the 1960's. There may be improvements and new applications in the 1970's, but the chief reasons for mentioning this military support mission are to recall a continuing function operative in the 1970's, and to note the possible importance of this navigational assistance to our strategic deterrent force, particularly our Polaris Fleet. Navigational satellites also have potential use for civil air and maritime traffic.

5. Weather and Climate Control. By the 1970's, meteorological satellite systems will provide on a continuing basis close monitoring of regional weather patterns and conditions, and a system of data-collecting satellites may pick up and relay to central data centers geophysical

information collected by automatic sensing stations in isolated land and sea areas. Data from these types of systems will combine with improved understanding of processes effecting weather and climate to facilitate both the reporting and interpretation of short-term conditions and long-range forecasting. Both the economic and military implications of such improvements, as well as their potentialities for cooperation, are of interest from the national security standpoint. However, from the standpoint of national security interests, another direction which efforts in this area may have taken appears to be of greater possible concern. There is no question that improved understanding and techniques will have come about.

[redacted]

6. Space Traffic. The cumulative effects of all the different quantitative and qualitative changes in space traffic that will have taken place by the 1970's may also be of concern. During the early space age there has been a tendency to consider "space traffic" as a matter of

primary interest to computers, and by the 1970's there will certainly be increased work for computers. But questions arise as to whether other aspects of the problem may not also assume increased significance. Will satisfactory techniques be evolved to minimize increasing pressures on the radio frequency spectrum and to ensure equitable allocations? Will the increased rate of launchings and perhaps the use of new launching locations involve increased probability of accident and risk to additional areas? How severe an accident might be caused by the unplanned re-entry of very heavy space stations? Will increasing use of nuclear power sources for space purposes present any major hazards? Will the total increase in space traffic, some devoted to the performance of operational functions, set limits on the kind or degree of scientific experimentation that may be performed in space? Finally, despite the vastness of space, will any problems arise from the growing accumulation of space debris? Whether these are the right questions is perhaps less important than recognition of the fact that an effort ought to be made to determine whether any major difficulties of this character are likely to confront us in the 1970's and, if so, whether they would be likely to present special problems from the standpoint of national security interests.

C. TRENDS IN INTERNATIONAL COOPERATION

1. Advances in space technology and the extension of activities in the exploration and use of outer space will by the 1970's have created

both the opportunity and the need for additional international cooperation. Such cooperation will have expanded at various levels--bilateral, multilateral, and more broadly international levels. It will involve increased participation by other countries in scientific and operational space efforts and also efforts to create a workable international "framework" within which space activities can proceed on an orderly and acceptable basis. Cooperation in some military activities will probably have been initiated (within alliance systems) as well as cooperation in civilian programs.

2. Apart from advancing specific scientific, economic, and military objectives, the United States is likely to have found cooperation an increasingly useful means of advancing such possible political objectives as the following:

a. The general strengthening of international institutions. Objectives in this area could go well beyond the more immediate concerns of space activities. Insofar as space activities themselves are concerned, cooperation may help bridge the gap between the space powers and others, and United States support of broadly cooperative endeavors (in addition to efforts of a more limited character noted below) may have helped to create a climate conducive to acceptance of kinds of activities and arrangements in which the United States may have an interest.

b. The strengthening of ties with specific countries or areas. In addition to the general political usefulness of cooperative arrangements with other countries, increased cooperation may have lent itself to such objectives as: (1) the enhancement of the prestige and position of particular countries in various geographic areas; (2) the involvement of other countries in United States programs with a view to giving such countries a direct stake in opposing possible continuing Soviet efforts to restrict or embarrass United States efforts; and (3) the securing of agreement for such support as territorial access which might be needed by the United States.

c. The strengthening of alliance systems. Cooperation in military space efforts on an alliance basis might have served to strengthen alliances politically as well as militarily.

d. The improvement of relations with the Soviet Union. Cooperative arrangements with the Soviet Union may contribute, at least in a general sense, to the improvement of United States-Soviet relations. It should also be noted that one effect of an active program of cooperation with other countries may be to bring pressure to bear on the Soviet Union to end the isolation in which its own efforts are conducted. Developments in the 1960's have already indicated progress in this direction.

3. Cooperation in the conduct of space activities, as well as in their coordination and regulation, can be viewed as a potentially

important means of containing or at least of helping to define the threat in the presence of a continuing arms race. For example, when very large, very heavy space stations (probably manned) go into orbit, uncertainty as to their purpose may increase tensions. Cooperation in such activities could be perhaps the most effective means of preventing misinterpretation of their significance. There would, of course, be a cost in terms of high-lighting activities which were not conducted on a cooperative basis, but if the arms race continues into the 1970's, the cost of not cooperating in some activities may prove to be higher than the cost of cooperation.

4. In a continuing arms race, the limits imposed on international activities would tend to be lower than under other circumstances. It is characteristic of the arms race in general that the fear of revealing too much and the fear of losing flexibility are strong concerns in the decision-making process. Such concerns are legitimate, but they can sometimes be exaggerated with the result that the decision-making process may err too heavily on the side of caution. If the arms race as a whole continues, and particularly if space weapons are introduced, such concerns would be constant factors in the situation and would tend to exert restraining pressures on the normal tendency of space activities to move in an increasingly international direction. However, such pressures are more likely to operate on a selective basis than to erect an insurmountable barrier against all change.

5. If substantial arms control and disarmament arrangements have been achieved by that time, the limits of international activities would, on the whole, be more flexible. Moreover, the effectiveness of arms control and disarmament arrangements would be reinforced by the extension of cooperation not only in outer space activities but other fields of science and technology as well. By definition, full cooperation would mean the absence of scientific and technical surprise. Advantage might still accrue to the state that was capable of exploiting scientific and technical developments most effectively, but it might be possible to keep the problem as a whole within manageable proportions. The question is not likely to present itself in terms of "no cooperation," on the one hand, or "full cooperation" on the other. However, in determining how much cooperation should be undertaken the foregoing considerations may have assumed a prominent role by the 1970's.

III

SPACE WEAPONS

A. THE RANGE OF POSSIBILITIES

1. It has yet to be established that concepts for weapons applications of spacecraft will offer advantages over or be competitive on a cost-effectiveness basis with present techniques of accomplishing similar missions; the technical feasibility of performing certain other military missions in space remains to be determined. Insofar as arms control and disarmament are concerned, no international agreements have yet been reached, and the feasibility of effective arrangements remains in the conceptual area.

2. As used here, the term "space weapons" includes both offensive and defensive weapons applications of spacecraft, and earth-based systems directed against spacecraft. To date, the primary offensive mission envisaged for spacecraft has centered around the delivery of nuclear weapons against area or point targets on the earth. Action against spacecraft in orbit might be taken by earth-based systems or by other spacecraft. In addition, at least in theory, spacecraft could be used for area defense against earth-to-earth ballistic missile attack, this concept appearing to present more difficult technical problems than the other two. Considering the several possible missions for space weapons, it is likely that some types of space weapons will have come into being by the 1970's.

3. In considering possible future military missions in space--and this is true of support missions as well as of offensive and defensive missions such as those examined below--a question arises as to whether man's contribution can best be made from the earth or through direct participation in space-borne elements of a given system. No effort is made here to pre-judge this question one way or the other. However, it would be desirable to determine whether command control and operational flexibility or over-all system reliability would, in fact, derive sufficiently important benefits from man-in-space to justify the effort. In the presence of an arms race continuing into the 1970's, it would seem important to know what man can and cannot do in space and in designing specific systems to examine the trade-offs involved in including or excluding man from the spacecraft themselves.

4. The range of arms control and disarmament arrangements which might affect extension of the arms race to outer space is fairly broad. Measures specifically intended to prevent or at least delay the emergence of offensive space weapons have already been the subject of discussion with the Soviet Union. One might conceive of a number of broader arms control and disarmament arrangements intended to halt the arms race and increase the stability of the present situation; almost any such arrangement would have the effect of precluding one or more, but not necessarily

all, of the potential weapons uses of outer space. What is technically termed "general and complete disarmament" would seem to preclude space weapons entirely, or at least preclude their national use.

5. In a previous section, it has been suggested that in the absence of major changes, it would be expected that military support missions would continue to be performed in space in the 1970's, although similar missions might concurrently be performed in support of various types of arms control and disarmament arrangements. The prospective relationship of space weapons with arms control and disarmament presents more complex questions, and no attempt will be made here to develop a single composite picture. The approach adopted in the following sections is to examine each of the major weapons applications of spacecraft first in its relationship to a continuing arms race, and then in its relationship to varying degrees of arms control and disarmament which might be achieved by the 1970's.

B. ORBITAL NUCLEAR DELIVERY VEHICLES

1. Alternative Modes of Operation. Two principal modes of operation of the orbital nuclear delivery vehicle have been identified.

a. Under the first and more "conventional" mode, the spacecraft would, in effect, be employed as a launching platform from which nuclear weapons-carrying re-entry vehicles would be de-orbited against point or area targets (depending on achievable accuracies and targeting policy).

The mission involved would thus be comparable to that of the ballistic missile.

b. The second mode of operation would involve the detonation of nuclear weapons at low orbital altitudes in order to achieve widespread thermal ground effects.

c. For both modes of operation, reliability and command and control would present major operational problems, and resolving those problems would represent a major element of the cost of the system involved. For these reasons, if not for others, the possibility of deployment in space during a period of crisis should be borne in mind as an alternative to possible efforts to maintain a deployed force on earth in a continuing state of operational readiness.

2. Present Competitiveness with Other Means of Delivery. As previously indicated, existing launching capabilities of both the Soviet Union and the United States would suffice for the establishment of a rudimentary force of orbital nuclear delivery vehicles of the de-orbit type in the near future. However, other factors weigh more heavily than launching capabilities in considering the problems involved in introducing an orbital nuclear delivery vehicle in the near term.

a. Unless the number of spacecraft comprising an "operational" force were large, the force would have limited operational effectiveness. Delivery accuracies would initially be such that the force would be

directed against area rather than point targets, and targeting flexibility would be low. The force would probably be stored in near space and would lack significant in-orbit maneuverability, circumstances which would make the force potentially vulnerable to interception or piecemeal attrition. In view of problems which have been encountered with the reliability of spacecraft, the mean-time-to-failure of specific vehicles comprising such a force would be comparatively short; in terms of what could actually be counted on, the mean-time-to-failure would, in the absence of extensive further development, probably be no greater than a few weeks to a few months, perhaps initially no greater than a few hundred hours. The problem of maintaining such a force in a state of operational readiness even for limited periods would be substantial, and the risk of accident could be high relative to the risk involved in earth-based systems.

b. Capital and operating costs would be high, and the expenditure of energy required to place the force in orbit and maintain it through periodic (probably frequent) replacement of unreliable or decayed elements would represent an incremental cost not applicable in the case of ballistic missiles or manned aircraft. (However, these costs are comparable, in terms of cost effectiveness of competing alternative weapons systems, to the costs of hardening missile sites, constructing submarine missile-launching platforms, or maintaining a portion of the manned bomber force in air alert.)

c. On balance, such factors have supported the judgment that the orbital vehicle is not competitive on a cost-effectiveness basis with already available means of delivery. They also support the conclusion that any Soviet interest in the orbital nuclear delivery vehicle in the near term would be motivated primarily by political-psychological rather than military effectiveness considerations.

3. Competitiveness in the 1970's. In the context of an examination of outer space activities in the 1970's, the question arises as to the extent to which changes may have occurred in the conditions currently militating against the introduction of the orbital nuclear delivery vehicle. Will present assessments continue to be valid, or will changes in cost-effectiveness comparisons or in military strategy alter them?

a. As previously indicated, space technology as a whole will have made major advances by the 1970's. As a general matter, this will have tended to narrow the effectiveness gap between orbital vehicles and other means of delivery. Significant trends in this regard will have been further improvements in launching capabilities which will have made possible the placing of heavy spacecraft in more distant orbits or very heavy spacecraft in lower orbits; greater maneuverability; increased re-entry accuracy; development of sophisticated decoys; and improved reliability. Launching costs per pound in orbit will have decreased, and it is possible that they might have decreased sharply

in the event of a cost breakthrough in propulsion, a conceivable but uncertain development.* Total system costs, however, would probably be high, and the question of how high they might be would depend on the size of an operational force and the elaborateness of the concept it reflected.

b. By the 1970's, the effects of such changes may have made the orbital nuclear delivery vehicle itself more interesting, but they will not have obviated the need for further comparisons with other types of delivery vehicles. For its own part, the ballistic missile of the 1970's will have improved range, payload, and accuracy over the models of the 1960's, and the life-expectancy of a credible deterrent based on ballistic missiles would seem to be good well into the 1970's. The principal questions which arise in this regard are related to continued ability to survive a first-strike and continued ability to penetrate to the target. The measurement of vulnerability and penetration capability involves both qualitative and quantitative considerations.

(1) By the 1970's, hardened missile sites will have tended to become more vulnerable as the result of further improvements in the accuracies of offensive weapons delivery** and possibly from the coupling

of improved accuracies with higher yield weapons. However, insofar as United States hardened missile sites are concerned, it is not clear that the limits of dispersal plus hardening will have been reached. More importantly, qualitative improvements in Soviet offensive weaponry would have to have been accompanied by Soviet achievement of numerical superiority in order to effect a decisive change in the deterrent value of United States forces. This is a game which the Soviet Union is not likely to have won.

(2) Submarine-based missile forces might also, at least theoretically, have become more vulnerable as the result of improved anti-submarine warfare capabilities. It appears unlikely, however, that such improvements would have decisively impaired the effectiveness of the submarine force.

(3) Insofar as penetration capabilities of both land and sea-based missiles are concerned, the principal question mark is whether either side will have developed an effective anti-missile capability. By the 1970's, both sides will probably have deployed some type of anti-missile missile system. However, improvements in delivery techniques (among the likelier possibilities are such developments as decoys, multiple warheads, varied trajectories, or maneuverable re-entry devices) will probably have served to keep offense ahead of defense in the absence of a breakthrough, with saturation of defensive systems.

c. On the whole, then, although it is necessary to assume that by the 1970's changes will have occurred which might have affected both the survivability and penetration capability of existing means of delivery, it would appear necessary to assume a series of fairly extreme changes, occurring in a rather limited time period, in order to conclude that the effectiveness of a United States deterrent force, comprised of advanced versions of already available types of delivery vehicles, would have diminished to the point where orbital vehicles might provide an essential supplement or replacement. Moreover, to reach such a conclusion, the orbital options would, of course, have to be relatively less vulnerable and/or have a higher penetration capability than that of the forces they were called upon to supplement or replace. These possibilities do not appear likely.

4. Strategic Complications of the 1970's. The foregoing survey suggests a high probability that advanced versions of existing types of nuclear delivery vehicles will continue to provide a credible deterrent for an extended period of time. The converse of this conclusion would be that the orbital nuclear delivery vehicle is not likely to be an essential component of the deterrent force of the 1970's. It is important, however, to consider whether complications in the strategic picture of the 1970's might alter these conclusions.

a. One such complication might arise if the Soviet Union itself were to develop the orbital nuclear delivery vehicle and either

deploy an operational force on a continuing basis or hold it in readiness for deployment, say, during a period of crisis. In the near term, no more than token deployment is likely, and such a move would be regarded by the United States as being primarily of psychological significance. Such a force could, however, be more militarily effective by the 1970's. In either case, we would undoubtedly desire to be able to take defensive action, but it is not clear that there would be any reason for the United States to deploy a similar offensive force in space simply because the Soviet Union might have done so. From the standpoint of its own security, the United States would not logically have to match Soviet offensive capabilities in kind. However, it would be important to consider whether other countries might view a Soviet offensive move into space as upsetting the military balance.

b. Another complication might emerge from possible changes in basic military concepts. Thus, in the presence of a continuing arms race, counterforce strategy is likely by the 1970's to have suffered from the effects of qualitative and quantitative changes in operational forces of strategic nuclear delivery vehicles. Counterforce targets may well have become so numerous, so dispersed, or so invulnerable as to make the strategy unworkable in any practical sense. Although an offensive strike might still attempt to destroy opposing strategic forces, such an objective is not likely to be credible, and whether

intentionally or not, deterrence might come to rest more on countervalue strategy. Alternatively, a nation might intentionally choose not to try to match its opponent's forces but rather to rely almost exclusively on a countervalue deterrent force, which might be smaller numerically (although probably not "small" in any absolute sense). Under either approach, survivability would be a key factor, but as long as survivability could be achieved as effectively and probably more economically undersea or underground, storage in space would seem advantageous only to the extent that it was considered necessary to complicate further the problem confronting the mounting of a first strike by an enemy.

c. Pursuing the countervalue theory one step further, the question arises as to whether there is any reason to believe that a force stored in orbit, assuming that it was survivable, might offer a more credible deterrent than some other equally survivable force. For example, a force of very high yield nuclear weapons designed for detonation at low orbital altitudes might be one means of signalling with a relative lack of ambiguity that the cities, population, and economy of the opposing side were the intended targets in the event of need to retaliate. However, as a practical matter, the objective of giving an unambiguous signal in this manner might be incompatible with the objective of survivability of the force.

d. If the logic of events is moving in the direction of countervalue strategy, the question arises as to whether storage of nuclear weapons in space might reverse the trend by drawing fire away from the earth. Unfortunately, although some fire might thus be diverted, spaceborne capabilities would probably be viewed as additional rather than substitute targets, and the threat of a retaliatory strike against cities, populations, and economies might continue to be regarded as a more effective deterrent against attack than a promise (which could not be verified in any case) not to attack such targets.

e. Finally, the strategic situation in the 1970's might be such as to place an even higher premium on controlled or delayed response and possibly also on the ability to retain a portion of the force unexpended in order to increase bargaining power in the event that bargaining was a practical possibility. Again, the key question is really the survivability of the force.

f. On balance, then, the orbital nuclear delivery vehicle does not appear to provide the basis either for initiating some unique strategy not achievable by other means or for resolving the complexities of strategy of the 1970's. It could, however, make the strategic situation more complex. There could conceivably be advantages in this, but it is axiomatic that it is difficult to complicate an enemy's problems without also complicating one's own, and it may become increasingly

important to try to determine when the point of diminishing returns has been reached in seeking safety through complexity. Finally, there is an outside chance that if the Soviets exerted very great efforts in this direction and the US only feeble ones, that they might attain a militarily significant or even superior offensive system for attacking the earth.

5. Special Problems Respecting Orbital Delivery Vehicles. Should it have become necessary for the United States to have developed and introduced a force of orbital nuclear delivery vehicles by the 1970's for any of the foregoing reasons or simply as the result of the dynamic pressures of a continuing arms race, it would have had to face a number of problems. The question of reliability would have been one of these; the question of command and control would have been another. The latter problem is already difficult, and the introduction of orbital delivery vehicles would appear likely to make it even more so. In addition to its technical aspects, the problem involves consideration of the circumstances under which the weapons might be employed, the procedure through which an "attack" order might be given, and the manner in which such an order might be transmitted to the operational force.

a. If a relationship should exist between location of operational forces in space and their potential vulnerability to detection and interception, such forces would presumably tend to be positioned at increasingly great distances from the earth with corresponding increases in the period of time required for re-entry. If it

were necessary to coordinate such forces in a simultaneous strike also employing earth-based forces, re-entry might have to be initiated at an early phase of the mounting of a strike. Whether one side-effect would be an increase in early warning would depend on the detection capabilities of the other side. In any case, the ability to exercise positive control over the strike from space would be essential in order to preserve flexibility in last minute negotiations. If the space-based elements of the strategic forces were not used simultaneously with other elements but were held in reserve, the ability to call them into play when and where needed would be essential, although the practical usefulness of such forces at a late stage in an engagement would seem open to question.

b. Under some circumstances, however, pressures might arise either to exercise negative control or to delegate authority to utilize space elements of the strategic forces. Under circumstances where there appeared to be no way out of conducting a nuclear strike and under which there was a question as to the survival of the capability of exercising command and control from the earth,* the attack from space might be

initiated on a basis permitting the strike to proceed unless a countermanding order were given. Alternatively, spacebased controllers might be given authority to act under certain circumstances, e.g., failure of communications and failure to restore communications within a specified time, or an "awareness" on the part of the space-based controllers that a nuclear exchange had occurred on the earth. Neither of these arrangements would be politically desirable.

c. The effectiveness and survivability of communications would be crucial in all cases. The problems involved would relate both to the vulnerability of earth-based transmitting facilities (which would become prime targets) and the possible disruption of communications through artificially induced interference.

6. Inter-Action with Arms Control and Disarmament. At the present time, the United States is pursuing an announced policy of unilateral restraint (or unilateral arms control) with respect to the deployment of an operational force of orbital nuclear delivery vehicles. This policy does not rule out insurance against possible technological surprise by the Soviet Union in this field, and it is at least in part contingent on the exercise of similar restraint by the Soviet Union (although, for reasons previously discussed, the United States would not necessarily feel compelled to follow suit if the Soviet Union were to place a weapon of mass destruction in orbit). Looking ahead to the 1970's, it becomes important to consider whether either unilateral restraint, or a mutual agreement or understanding limited to one type of delivery vehicle alone,

could be expected to have survived in the presence of an arms race continuing on other fronts, and how the orbital nuclear delivery vehicle might have been affected by broader arms control or disarmament arrangements, had such been reached.

a. Prolongation of the arms race as a whole into the 1970's would necessitate periodic re-examination of the desirability of a separate arms control measure for outer space, whether such a measure took the form of unilateral restraint or whether a mutual agreement had been reached. A principal objective of such re-examinations would be to assess the continuing effectiveness of a deterrent based on advanced versions of existing types of nuclear delivery vehicles. As has been suggested in the preceding discussion, such a deterrent appears more likely than not to remain effective well into or through the 1970's. A second objective would be to consider whether the orbital nuclear delivery vehicle presented a more imminent and dangerous threat than had previously been estimated. In this regard, it should be recognized that in the presence of a continuing arms race there is very little likelihood that either the Soviet Union or the United States would be prepared to accept pre-launch inspection of all spacecraft in order to verify an agreed ban on the orbital nuclear delivery vehicle. As presently appears to be the case, both countries might continue to regard the possible gains from a fully verified ban on only one type

of weapon as insufficient to outweigh possible losses of technical and other intelligence resulting from pre-launch inspection and from the degree of access which such inspection implies. In the absence of pre-launch inspection increasing reliance would be placed on the assurance that could be derived from the availability of effective anti-satellite capabilities as a safeguard against technological surprise. As long as such matters as the foregoing were judged on their merits, there would be a reasonable prospect that at least the policy of unilateral restraint might survive for an extended period. However, it should be recognized that continuation of the arms race as a whole would probably exert heavy pressures against its limitation in one particular area.

b. Almost any broader disarmament agreement reached by the 1970's would probably have provided for the prohibition of the orbital nuclear delivery vehicle.

C. ANTI-SATELLITE CAPABILITIES

1. Detection, Tracking, Identification, and Interception of Spacecraft.* The capability of destroying or neutralizing a spacecraft in orbit rests on a number of separate but related functions. The first of these involves

* Detection, tracking and identification are not necessarily associated with space weapons systems nor indeed necessarily even military, and our discussion of them in the context of interception should not be taken to imply a necessary connection.

detection of the presence of a spacecraft in orbit and determination of its path in space with sufficient accuracy to permit action to be taken against it. The problem then becomes one of determining whether a particular spacecraft represented a potential threat. If so, a means of taking action against it would be required. Finally, it would be desirable to know whether such action had been successful. In considering the foregoing functions, it is assumed here that both the United States and the Soviet Union have already recognized a requirement for an anti-satellite capability and that both sides will have acquired such a capability by the 1970's.* Assuming continuation of the arms race, questions arise as to the manner in which changes occurring by the 1970's may have affected the need for and character of anti-satellite capabilities.

a. By the 1970's, the problems of detection and tracking will have become more complex as the result of the general increase in space traffic, the increased volume of space in which spaceflight is likely to be conducted, and the ability of the hostile vehicle to perform in-space maneuvers. These developments will have required improvement

* For both sides such a capability would appear important as providing prudent military insurance against technological surprise and as extending the range of political-military options in dealing with various problems related to the use of outer space. At least in the case of the United States, an important additional consideration is the contribution that availability of an anti-satellite capability might make to minimizing the psychological impact of the possible introduction of orbital nuclear delivery vehicles by the Soviet Union.

and extension of earth-based detection and tracking capabilities utilizing passive optical, radar, optical maser, and other techniques. The extension of such capabilities would probably have required the placing of detection and/or tracking equipment at locations outside of the United States in order to determine the presence of an object in orbit, and to define its path in space at the earliest possible time, and possibly also in order to make use of such special vantage points as the equator. Refinement of computerized accounting and sorting equipment and techniques would also have been required. Computerized systems will automatically calculate and display the present and probable future path of possible targets and provide fire control, attack, and escape data. Whether spacecraft could themselves assist in the performance of detection and tracking functions (as through the use of satellites to detect launchings) would need to be considered; however, unless the changed conditions of spaceflight taxed the limits of earth-based facilities or unless it proved politically impossible to place such facilities at essential locations, principal reliance would probably continue to be placed on earth-based capabilities to perform these functions.

b. The problem of determining whether a particular spacecraft might represent a threat is difficult today and, in the absence of pre-launch inspection, is likely to remain so. The principal threat one would wish to detect would be the presence in orbit of a nuclear

weapon; however, other types of military spacecraft might, depending on the circumstances, also be regarded as potential targets. Under the best of circumstances it is unlikely that external spacecraft characteristics would provide a wholly satisfactory basis for determining the specific functions performed by the spacecraft, but the acquisition of data respecting such characteristics would probably have become increasingly important by the 1970's in order to facilitate, by process of elimination if not by positive identification, at least a narrowing of the range of functions which a particular spacecraft might be performing. In acquiring such data, it is possible that measurements made by earth-based facilities could usefully be supplemented by an inspector-satellite capability. Such a satellite could not be expected to provide unlimited data since it would be only as useful as the sensors it employed and since such sensors would, in most cases, probably have to be used in a manner which would not interfere with the spacecraft being inspected.* Moreover, since it would seem impractical to inspect all unknowns in space, the inspector-satellite would probably be used sparingly. It might prove to be the most useful in obtaining information on new types of spacecraft as they first appeared.

* The principle of non-interference is further discussed below. It is relevant at this point to note the possibility that spacecraft could probably be equipped with countermeasures against peacetime interference by inspector-satellites, and that in time of war there would probably not be an opportunity to await a report from an inspector-satellite prior to taking action.

c. Insofar as interception is concerned, initial intercept capabilities would have employed earth-to-space systems. As the geometry of the problem became more complex because of the increased volume in which spaceflight was conducted, it would have been necessary to seek corresponding improvement of earth-to-space intercept capabilities and perhaps to consider more seriously the desirability and feasibility of a space-to-space intercept capability, although the latter type of capability would presumably not have been introduced unless and until it had been determined that earth-to-space capabilities were inadequate to meet the threat. Non-nuclear destruction or neutralization techniques may be available. The size of the required force of anti-satellite weapons would have become a problem, particularly if the orbital nuclear delivery vehicle had been introduced or was considered an imminent or dangerous threat. The size of the force would tend to be determined in part by the success or lack of success in the development of techniques for identifying the functions of spacecraft, and in part by the number of spacecraft which might be considered potential targets under various circumstances. At least in theory, all unidentified objects and all known military support systems might fall in this group, though widespread use of decoys could present very great problems. It is conceivable that civilian support systems might also be considered potential targets in an extremity.

d. One conceivable though unproven possibility would be achievement of an efficient, highly maneuverable spacecraft with a capability for destroying all other space vehicles. A nuclear pulse propulsion system might provide such a means toward mastery of space, providing the other side did not possess the same or some other means of achieving the same effects, or effective countermeasures.

2. Special Problems Related to Use of Anti-Satellite Capabilities. The availability of anti-satellite capabilities is one matter; the actual employment of an anti-satellite weapon is another. It is possible that the use of anti-satellite weapons may have been attempted prior to the period under consideration in this paper. However, in the long run, the ability of either side to disrupt overtly the space activities of the other would probably have encouraged the emergence of the principle of non-interference in the conduct of most space activities. Such a principle would tend to be self-enforcing by virtue of the self-interest involved in avoiding retaliatory interference. There appear to be two sets of circumstances under which exceptions to this principle might materialize. The first would arise in the event that one side considered it necessary to take action against spacecraft of the other either in order to eliminate a perceived threat or in order to establish a precedent that such spacecraft were not entitled to enjoy freedom of space. Although action under these circumstances would be accompanied

by public justification of the action taken, the party initiating the action might still have to face the possibility of retaliatory interference by the other side. A second set of circumstances might arise if one side believed that it might be able successfully to interfere with space activities of the other without the source of such interference becoming known; presumably, however, there would be limits to the extent to which such operations might be risked. Even taking such possible "exceptions" into account, it seems probable that although it would be very important to have anti-satellite weapons available, it may by the 1970's have proved equally important not to use them.*

3. Inter-Action with Arms Control and Disarmament Arrangements.

Three aspects of the interrelationship between anti-satellite capabilities and arms control arrangements appear worth examining. The first of these involves possible effects of limited arms control arrangements on the character of anti-satellite capabilities; the second, the function of arms control and disarmament arrangements in target reduction; the third, the potential usefulness of anti-satellite capabilities in support of arms control and disarmament arrangements.

* The discussion of interference and non-interference relates specifically to a peacetime situation. The principle of non-interference would clearly not hold in time of general war. It would certainly also be subject to great pressure during periods of extreme crisis, when pre-emptive action against certain types of spacecraft might be considered desirable.

a. Two major separate arms control agreements have been offered by the United States which relate in part or in whole to outer space: the comprehensive ban on nuclear weapons test explosions has the objective of prohibiting such explosions in outer space as well as in other environments, and an agreement to prohibit the placing in orbit of weapons of mass destruction which would, of course, be concerned solely with outer space. Neither agreement would prohibit the development or use of anti-satellite weapons. However, in the presence of such agreements, use of non-nuclear means as the kill or neutralization mechanisms of such weapons might avoid creation of ambiguous situations.

b. A separate agreement to prohibit the placing in orbit of weapons of mass destruction would limit the targets against which anti-satellite weapons might have to be employed. However, in the presence of a continuing arms race, even a fully verified agreement of this character would not eliminate the need for anti-satellite weapons. Such weapons would still be required for a number of purposes: (1) to "enforce" the principle of non-interference; (2) to meet the situation which might arise if orbital nuclear delivery vehicles were introduced following abrogation of the agreement; and (3) to deal with other potential space targets in time of war whether or not the orbital nuclear delivery vehicle were introduced.

c. If, as is more likely, a fully verified separate agreement were not achieved, the availability of effective anti-satellite capabilities would provide increasingly important support of, and would probably help prolong the life of, a policy of unilateral restraint or of an agreed but uninspected ban on the placing in orbit of weapons of mass destruction. Anti-satellite capabilities might also support broader disarmament agreements which might have been reached by the 1970's, by providing a safeguard against the disruptive effects of possible unreported but detected space launchings. Depending on the character of such broader disarmament agreements, anti-satellite capabilities might have been placed in international hands.

D. ORBITAL ANTI-MISSILE CAPABILITIES

1. Interception from Orbit. The concept of intercepting ballistic missiles from orbit has been under study for a number of years. It is an attractive concept, since in theory it offers a means of interception during the boost or perhaps mid-course phase of ballistic missile flight, thereby effecting a kill well away from the territory being defended and during a phase of flight when the missile was least able to take evasive action. As a practical matter, however, the concept remains elusive, and moving from concept to operational capability appears substantially more difficult in this case than in the case of other space weapons. No assumption will be made here as to whether technical problems will have

been resolved by the 1970's. If such a capability had been developed, it might have been placed in operation as a supplement to, rather than a replacement for, earth-based anti-missile missile systems. Such an approach would be consistent with traditional air defense doctrine in that it would contemplate one line of defense at the most forward point practical and a last ditch defense through the use of the earth-based system.

One theoretical technique for anti-missile interception from orbit is intercept by lasers beamed from orbital vehicles. The speed and kill potential of lasers might make this technique feasible. The attenuation of the lasers would be significantly less of a problem than in the case of directing lasers through the atmosphere toward targets on earth. Formidable problems remain, however, such as the problem of an adequate power source to generate the laser beams, and command control.

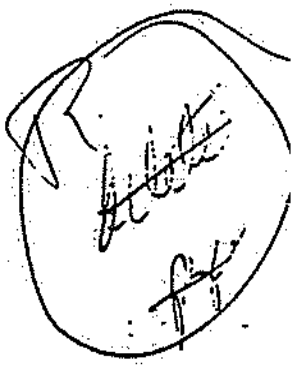
2. Special Problems Related to Orbital Anti-Missile Capabilities. Problems of reliability and of command and control would have political as well as military significance in this case, as in the case of other space weapons.

3. Inter-Action with Arms Control and Disarmament Arrangements. The inter-action of orbital anti-missile capabilities and possible arms control and disarmament arrangements which might have been reached by

the 1970's appears to parallel in many respects the case of anti-satellite capabilities. Insofar as support of arms control and disarmament arrangements is concerned, the availability of an effective anti-missile capability (of any type) might make the theoretical problem of the hidden or clandestinely produced missile more manageable, and it is possible to conceive of a trade-off between the amount (or effectiveness) of inspection and the continuation of an effective anti-missile capability provided that the latter was not itself capable of being used for offensive purposes.

E. OTHER SPACE WEAPONS

The foregoing discussion has centered around the major foreseeable possible weapons applications of spacecraft. By the 1970's, however, additional possibilities may have materialized. One example might be the use of satellites for countermeasures against communications, radars, and so forth. In considering national security implications of space activities in the 1970's, it would be important to identify and assess any such additional possibilities. In this regard, consideration should be given to the question of the degree to which developments in other fields, such as laser technology (above noted) might combine with space technology in other military applications.



IV

OPTIONS AND THREATS IN THE SPACE AGE

At the present time, options in space are subject to rather severe limitations imposed by the scientific and technical state-of-the-art. Although the potentialities of the 1970's are not limitless in this regard, the range of practical options will be much broader. It is necessary, however, to distinguish between the increasing accessibility of space in a scientific and technical sense and the international context in which space activities will be conducted.

The political, economic, and technical capability to control the use of spacecraft (that is, to launch or not to launch, to experiment or not to experiment, to release data or withhold them, to perform services or withdraw them, to interfere or not to interfere) may by the 1970's have come to represent an important element of power. But how will such power be exercised? And to what ends?

One state's option may, in the view of another, represent a threat to the latter. Moreover, in a world which may have come to depend on spacecraft for the performance of essential functions (and which would in any case be subject to the hazards as well as the benefits of the space age), control of the use of spacecraft is likely to have become vested with a high degree of public interest at the international level.

Accordingly, even leaving aside the question of space weapons, what happens in outer space between now and the 1970's as well as during the latter period will be of mounting international concern. Purely unilateral control is unlikely to be either adequate or successful, and in this as in other areas perhaps the most crucial question is whether international arrangements can be developed to enable man effectively to control an increasingly complex environment extending literally "out of this world"—but always still affecting it.

It is always possible, of course, to make an already complex situation more difficult, and space weapons would seem well suited to this purpose. The development of anti-satellite capabilities is proceeding at the present time. The use of outer space for offensive missions, however, is not yet a foregone conclusion.

A. HOPES

While the matter is not one entirely susceptible to unilateral control, surrender to the pressures of an unbridled arms race is not inevitable. Although states may wish to have available a broad range of technical options in the weapons field, options do not necessarily have to be exercised. Responses to what happens in space need not invariably take place in space. They need not always be "in kind."*

* The obverse, of course, is also true; space systems may be used or threatened as a counter to some action initiated with an earth-based system.

The commitment does not have to be made in one sweeping decision to proceed with or to reject all space weapons. The real problem in arriving at decisions on specific space weapons is to be as certain as possible what kind of commitment is being made and where it may lead.

Whether a significant degree of arms control and disarmament can be achieved by the 1970's, which seems questionable, space activities can contribute in a variety of ways to the keeping of the peace. In the context of the total peacekeeping problem, the contribution of any single space activity will not be decisive. However, it is clearly in the national and international interest to ensure that this aspect of space activities, as well as others, be fully explored and that possible contributions be fully realized.

Moreover, the long-term direction in which space activities are moving is one tending to encourage increased openness, interchange, and interdependence among nations. Although a world characterized by these conditions will have its own problems and vulnerabilities, such a world is more likely to be conducive to the achievement of stabilized peace than a world in which a shoring up of the walls of national separateness has taken place. The trend toward increased openness, interchange, and interdependence is not irresistable, but the walls are not immovable. In any event, spacecraft will offer more than one way of hurdling them.

Military Uses of Space: 1946-1991

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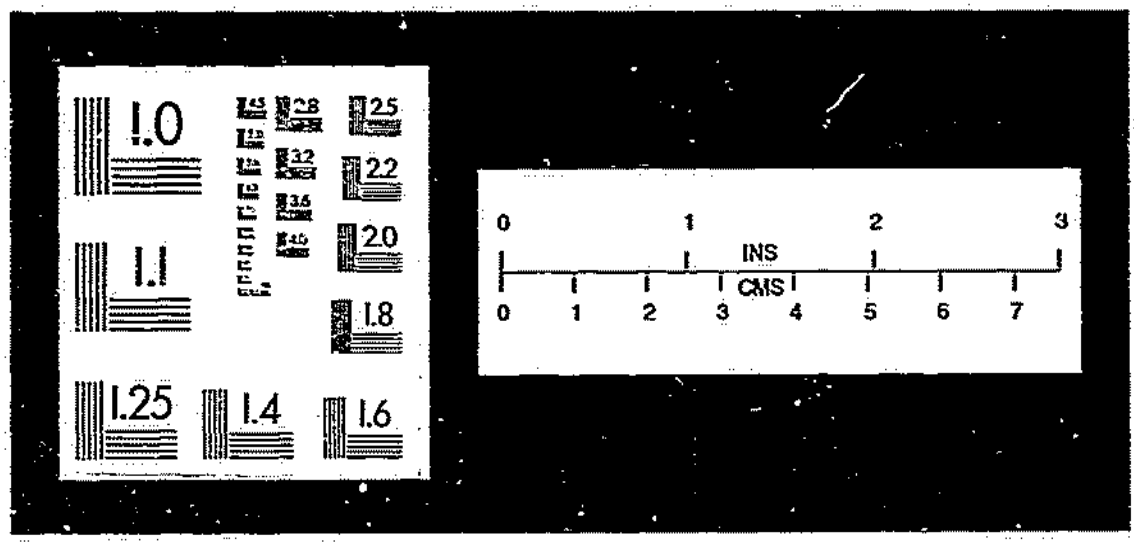

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B. DANGERS

We are concerned with the entire range of possible developments in space which could affect our national security, and have attempted in this study to examine the chief ones. Without focusing our attention too narrowly on "worst case" possibilities, it is clearly important to consider even remotely possible contingencies in which our security might be imperiled. Are there any conceivable foreseeable developments which could pose a mortal threat to our security?

The "worst case" threat would arise if the USSR achieved, in the absence of a comparable or countervailing US achievement, efficient highly maneuverable spacecraft capable of destroying all other space vehicles and earth-based ballistic missiles traversing space. If, for example, the Soviets succeeded in developing a nuclear-pulse or other propulsion system for maneuverable space flight of large spacecraft, coupled with a laser or other capability to destroy our missiles passing through space, and with a nuclear delivery system not countered by other US defense, and if furthermore the United States possessed neither a comparable capability nor an effective strategic capability other than with missiles they could intercept, we would be in deep trouble. This would represent the conjunction of a series of developments the statistical possibility of which would be very low even apart from what we may do. And

even in this very remote case, to be sure, there would be the questions of numbers and of costs and of countermeasures. But if we are looking for conceivable very great danger from space, this would be a candidate. And as such, its major elements deserve most serious consideration and appropriate "insurance" measures by us. There are, of course, many lesser military developments which could compound our own military problems, short of this extreme challange.

A second problem-area is the range of dangerous confrontation on earth, which may arise from intentional interference by one side or the other with actions of the other in space which it deems so dangerous or undesirable as to warrant active countermeasures. Closely related to this problem is the question of establishing, by overt act or by inaction, generally accepted rules of space activity.

Another very different contingency would be the Soviets diverting us into space. Presumably we would never be so mesmerized by space or by will'o-the-wisps of space weaponry that we would neglect other theaters. But it is conceivable that the Soviets could contribute to misleading us into dissipating much of our efforts into cosmic ventures while they pursued more down to earth politico-military courses of action. If they were to do so, though, they would have to run the risk that we would find a key development leaving them far behind.

R

C. PROBLEMS

It seems appropriate to conclude this report with a few words on "problems"—the dangers may never arise, the hopes may never be realized, but problems there surely will be.

The basic problem is to reconcile insurance against possible dangers in space with efforts to realize opportunities in that medium, within the broader context of our complex of objectives on earth. We cannot afford either to meet all possible dangers nor to ignore them; we cannot fulfill all opportunities without either laying to rest or tempting some dangers; we cannot pursue infinite aspirations with finite means.

Nonetheless, we can and must pose the more likely and (a different matter) the most dangerous challenges and squarely face the question of appropriate levels of insurance. This includes a vigorous scientific and developmental exploration of possible space weapons and defenses against them.

We can also attempt to direct not only our own but all of man's space efforts, to the greatest extent compatible with more specific security considerations, into the most productive and least risky paths. We should, again with an eye to specific security requirements—and not just an open door to all possibilities—press now for international acceptability of both freedoms and constraints which will best serve our long-run objectives in space.

There will also be political problems of other kinds. For example, outer space developments will accentuate, rather than mitigate, the differences between the industrial countries on the one hand and developing countries on the other. This increasing divergence will in itself argue that the US may find it desirable to be responsive to the worldwide desire for international participation in some outer space programs. There may be an increasing reaction in the economically underdeveloped countries against great expenses in space exploration while millions on earth barely subsist.

The present study has attempted to sketch out considerations which can assist in meeting these hopes, dangers and problems.

Annex A: Terms of Reference

The Situation

With our present primitive knowledge of outer space and the technology of its exploitation, we know that this new medium is susceptible to a rich spectrum of uses--some non-military, some military. Some of these uses are compatible with one another; others may be mutually exclusive. To some degree, the pattern of cooperation or conflict which develops in outer space may contribute to the character of relations among nations.

The United States is developing nationally a broad capability to pursue both scientific and military uses of space. What we lack is an understanding of the extent to which US development programs may determine the pattern of the use of outer space in the 1970's and beyond, and a national policy to shape the pattern in the over-all national interest.

The Task:

1. Survey the potential systems for deployment in outer space during the 1970's, in the following areas in particular:

a. Weapons of mass destruction in orbit

b. Active and passive defense systems

c. Arms control systems

d. Scientific and other non-military systems

e. Military support systems.

2. Consideration of the international politico-military environment in which each of the above systems would represent a logical national or international effort, and of the impact on the environment of the deployment of such systems. Cover such questions as:

a. What systems appear incompatible, as fitting into totally different international contexts?

b. In case incompatibilities are found, which environment and which systems are more in the U. S. interest?

c. To what